Application Software Development

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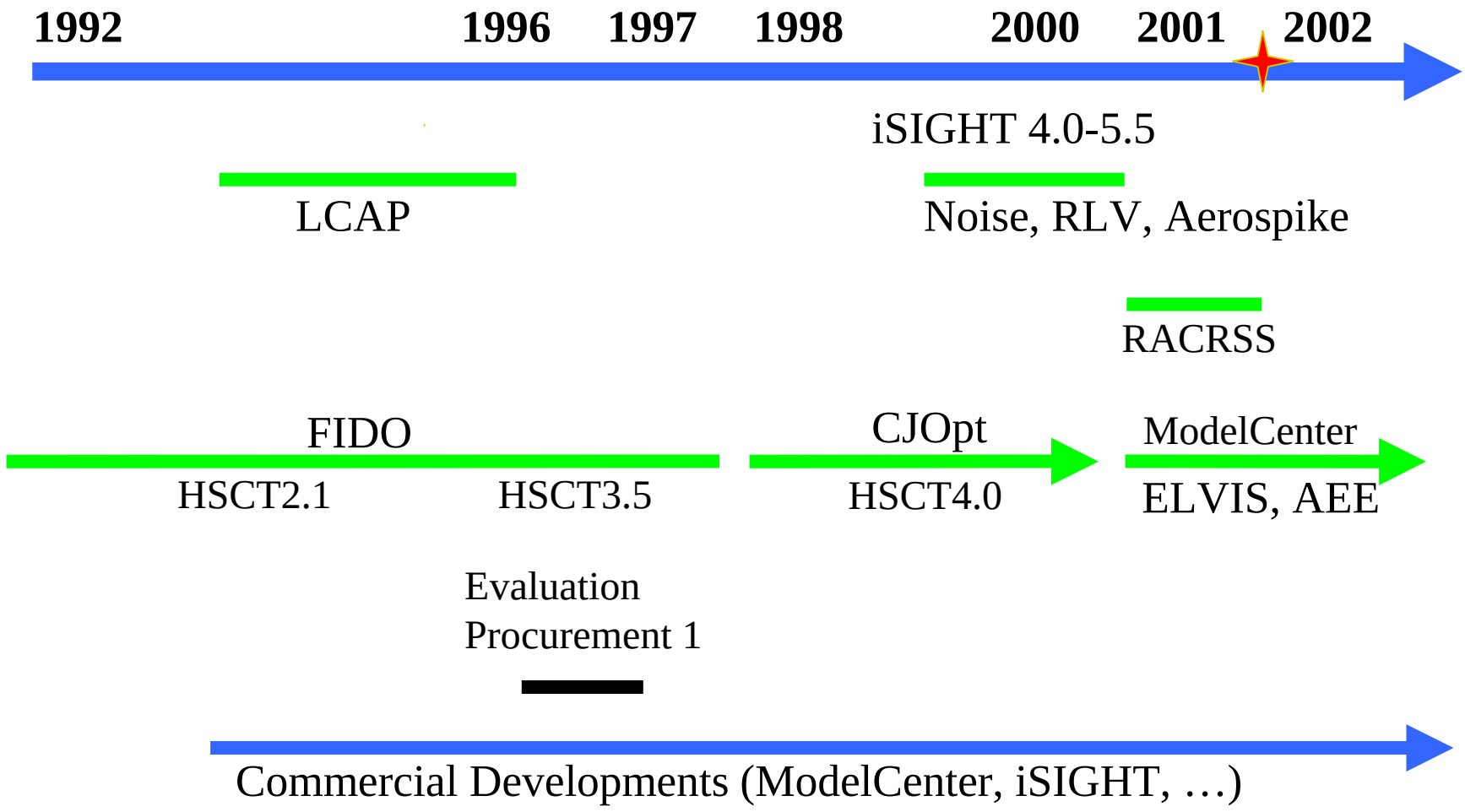
Outline

- Application of frameworks
  - definition
  - evaluation
  - commercial framework application
- Application of software engineering practices
  - definition
  - Rational Unified Process
  - application to projects
- Recommendations

Framework Definition

A framework for multidisciplinary design optimization processes is defined as a hardware and software architecture that enables integration, execution, and communication among diverse disciplinary processes.

Roadmap to a MDO Framework



First Framework Procurement (’96-’97)

- Motivation
  - FIDO limitations
  - resource limitations
  - commercial developments
- Process
  - generated requirements list (WPAFB, GRC, MDOB, CAS Office, CSC)
  - evaluated frameworks (MDOB, CAS Office, CSC)
  - made decision to select COTS framework
  - posted RFP leading to iSIGHT procurement (’97)

Commercial Frameworks

- iSIGHT (Engineous Software)
  - early versions applied to smaller HPCCP/HSCT applications
  - feedback given to Engineous on improving product
  - funding provided to develop capabilities in distribution, parallelism, debugging, etc.
  - applied successfully to several MDOB projects (Noise, RLV, Aerospike applications)
- ModelCenter - Analysis Server (Phoenix Integration)
  - actively being used in several RLV application projects (ELVIS, AEE)
  - feedback given to Phoenix on issues such as security, parallelism, etc.

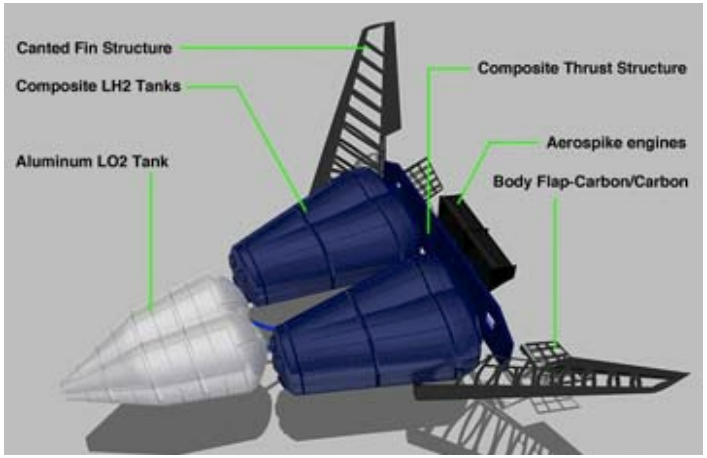
Aerospace Applications Implemented in iSIGHT

Summary of Aerospace Applications

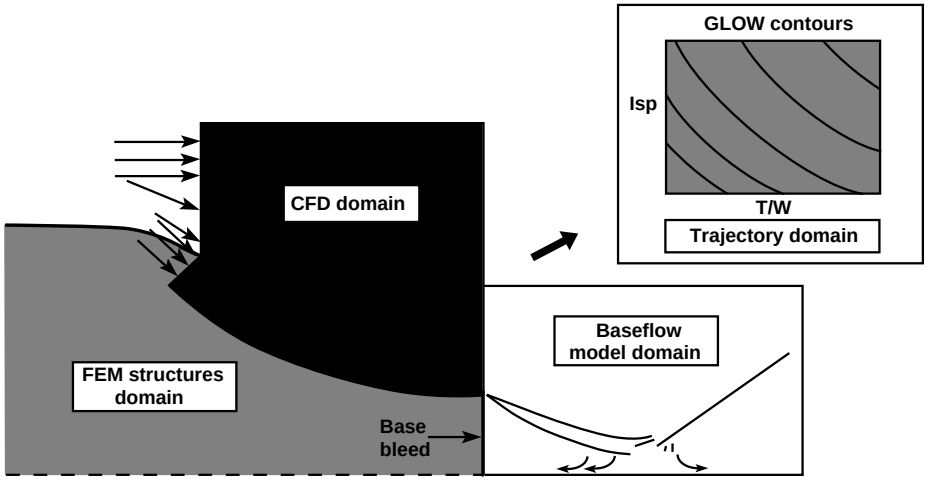
Application	Number of simulation codes	Number of design variables	Number of constraints	Estimated CPU time for analysis task
Launch vehicle sizing	2	2	1	90 minutes
Aerospike nozzle design	4	18	564	90 seconds
Trajectory optimization	1	5	7	1 second
Acoustic liner research	1	60	0	20 seconds

Typical landing by XV-15 tiltrotor vehicle

Internal Arrangement



Conceptual design of RLV showing fuel tanks and aerospike nozzle



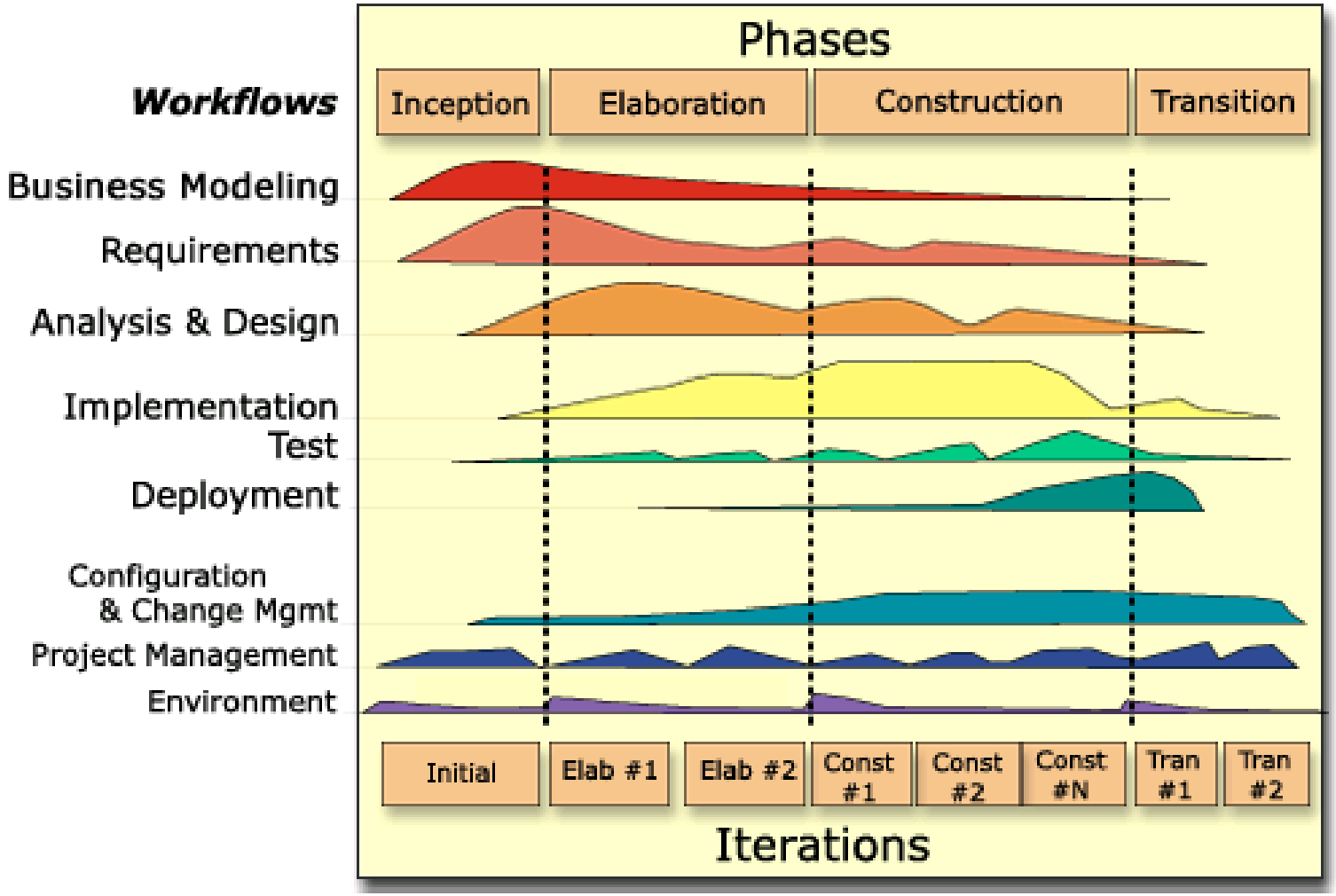
Multidisciplinary analysis for aerospike nozzle design

Application of Software Engineering

- Definition
  - application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software

- Software engineering areas
  - software management (lifecycle)
  - requirements management (Rational Rose)
  - design (Rational Rose)
  - implementation
  - configuration management (TRUEchange, ClearCase LT)
  - testing

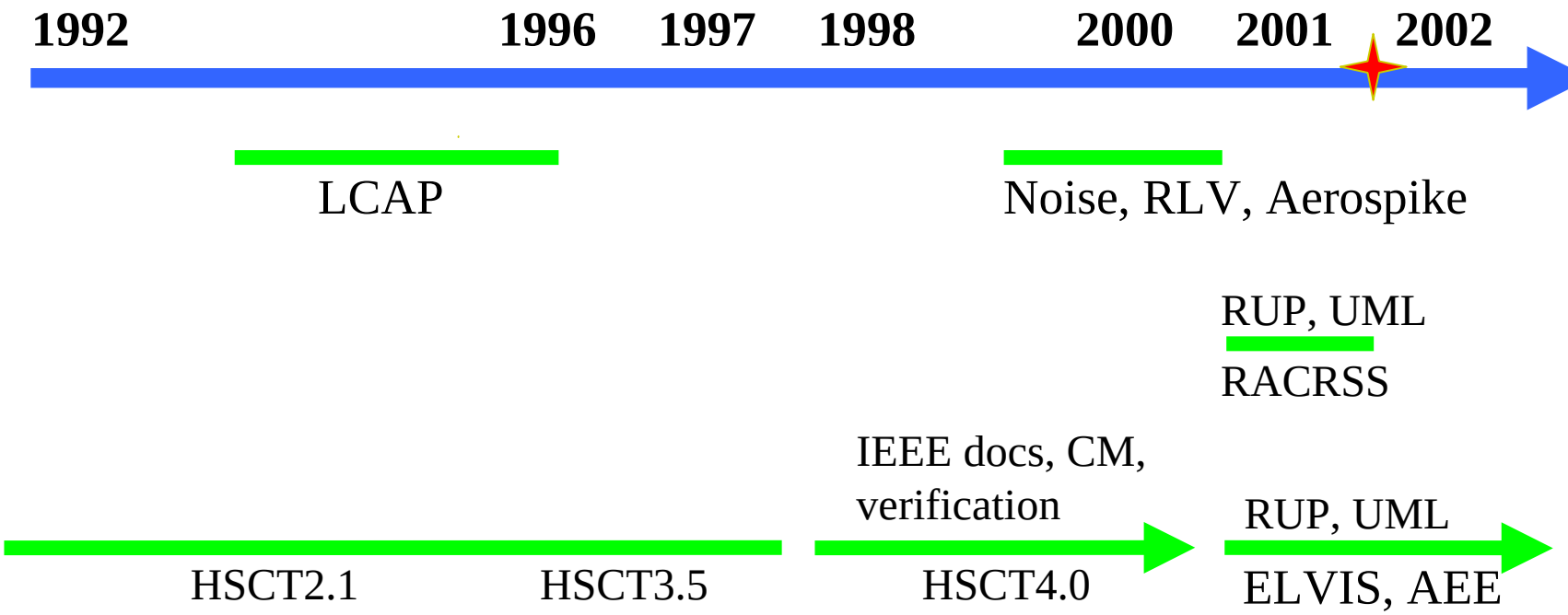
Rational Unified Process (RUP)



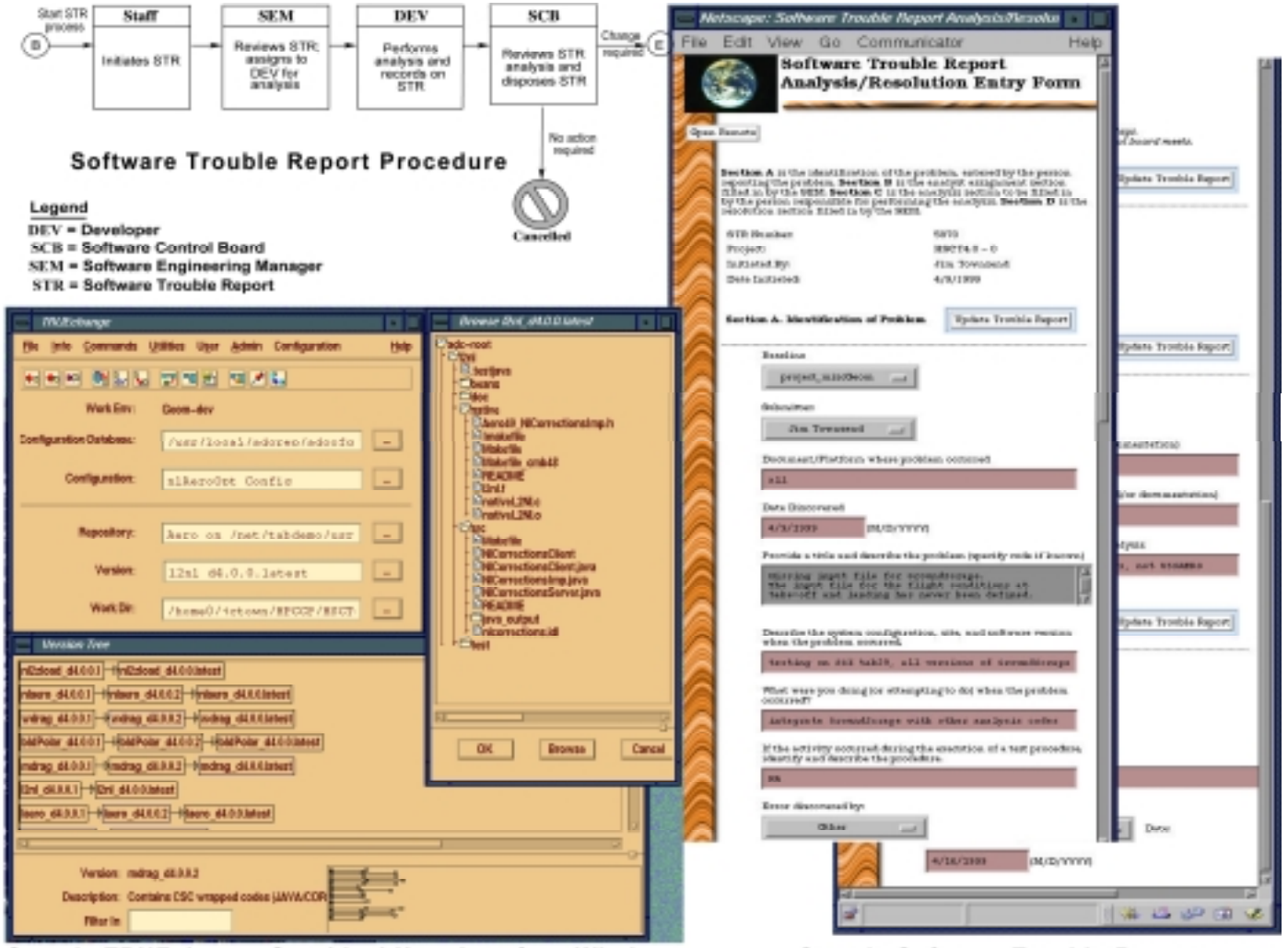
Benefits of the RUP

- Iterative software development process
  - Focuses on identifying risks early
  - Focuses on establishing a stable architecture
  - Based on proven best practices
- Visual modeling using Unified Modeling Language (UML)
  - UML is an industry standard
  - Increases team communication
- Use case (functional requirements) driven
  - Play a major role in management, requirements, design, and test
- Guidelines, tool tips, and templates

Roadmap to Advanced Software Development



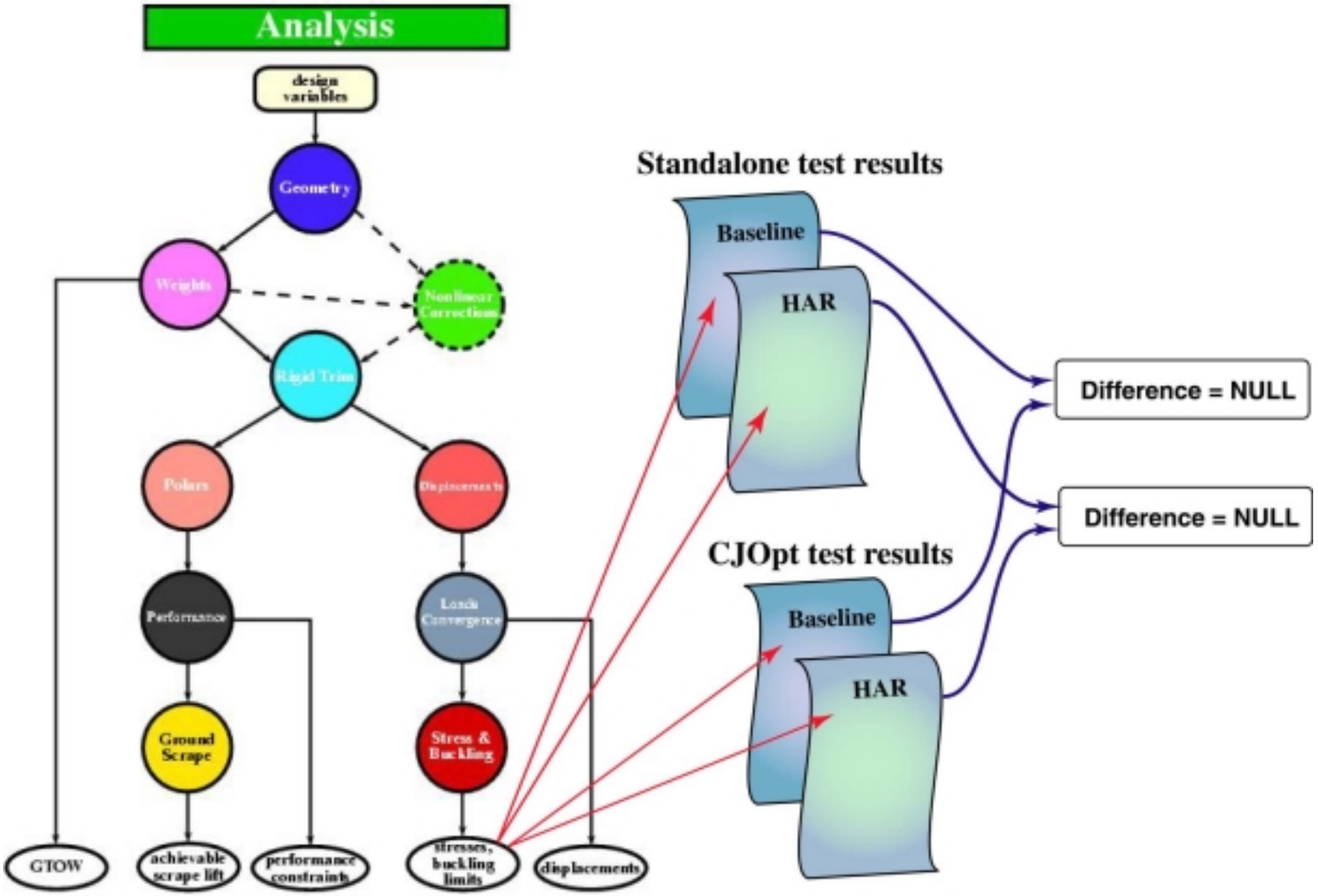
SCM for the HSCT4/CJOpt Project



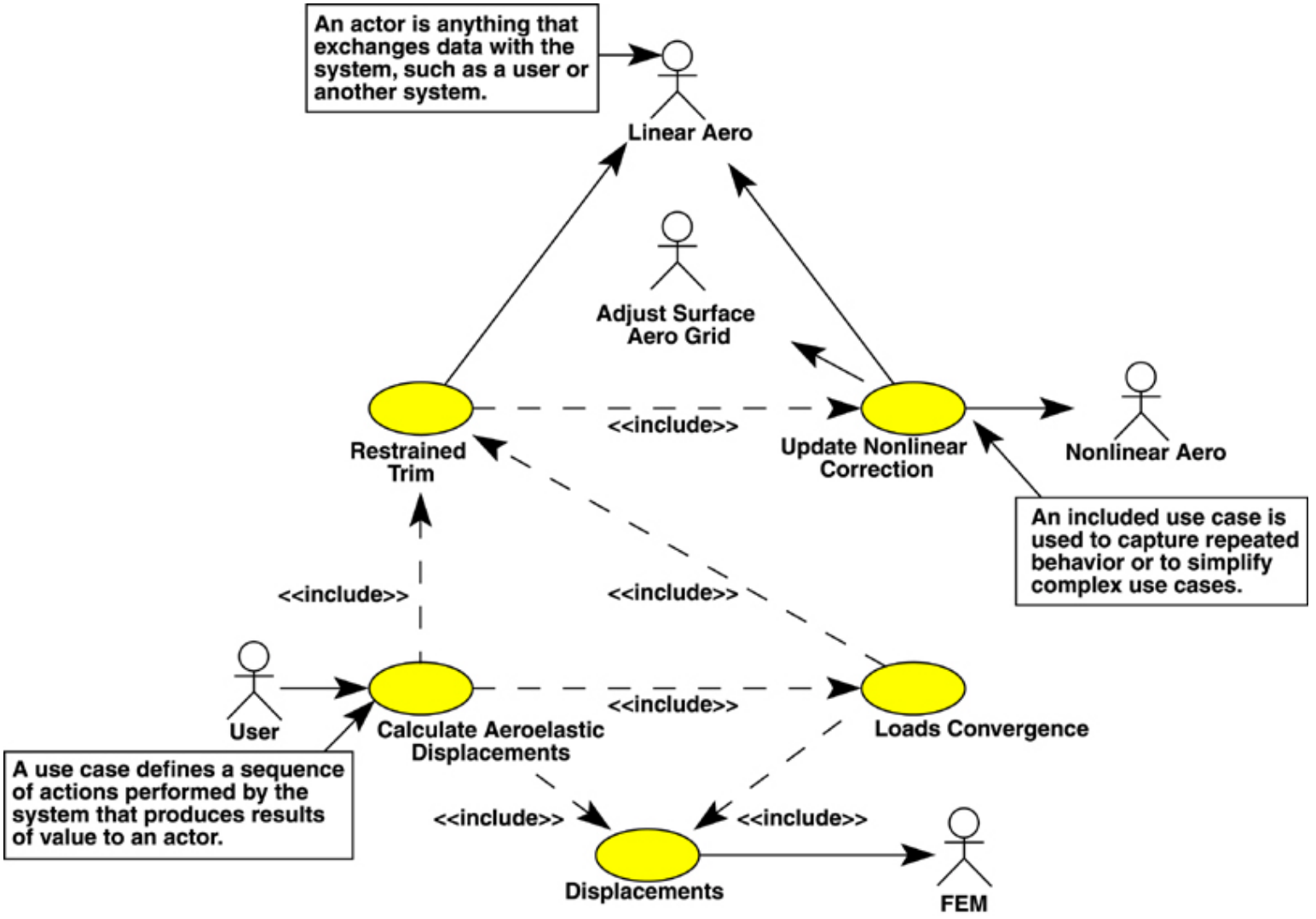
Sample TRUEchange Graphical User Interface Windows

Sample Software Trouble Report

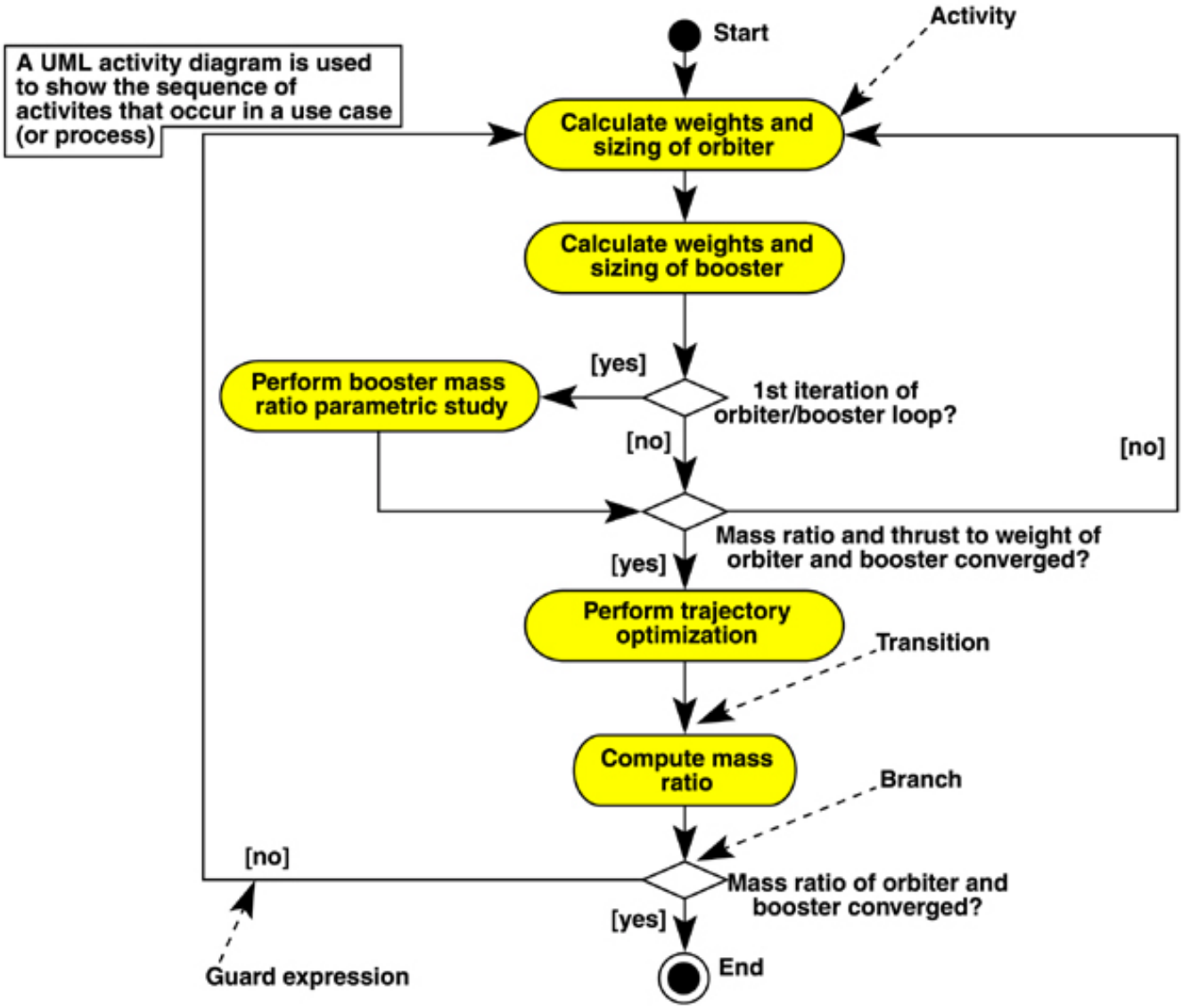
HSCT4.0 Verification Process



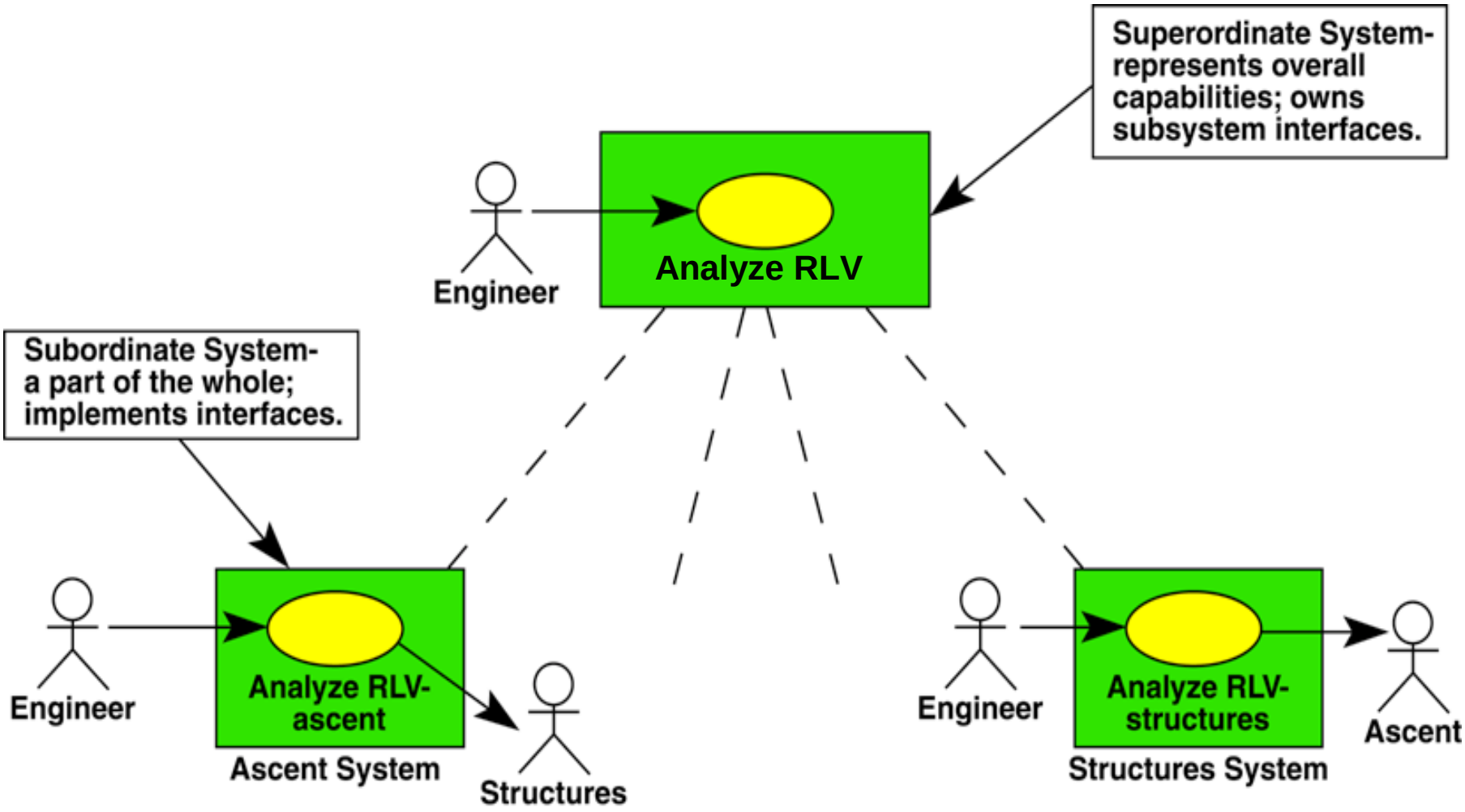
RACRSS Use Case Model
Aeroelastic Displacement Calculations



Activity Diagram for AEE "Analyze Performance" Use Case



ELVIS Use Case Model
System of Interconnected Systems



Recommendations

- Document software architectures with UML
- Manage projects using RUP
  - Tailor RUP for research projects
  - Manage scope
  - Establish clear roles
  - Identify project artifacts

References 1

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